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**EP 0967128 A2** **WO 2001/023226 A1**  
**DE 019957872 A1**

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INT CL<sup>7</sup> **B60R 21/34, B62D 25/10 25/12**  
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(54) Abstract Title  
**Impact responsive means for raising a vehicle bonnet**

(57) A safety device to lift a rear part of a hood or bonnet 42 of a motor vehicle includes a lifting element 1 located beneath and actuable to lift the rear part of the hood or bonnet 42, a hinge having an arm 40 pivotally connected 45 at one end to a main part of the vehicle and releasably connected in part to the hood or bonnet 42 by a release mechanism which releases the connection in response to actuation of the lifting element. Preferably the lifting element 1 is a rupturable, plastic canister (2, Fig 2) containing an inflatable sleeve (10, Fig 2) and carrying a barbed prong (13, Fig 2) the head of which is received in a recess 46 on the bonnet upon deployment of the device. Advantageously the safety device allows for extensive deformation of the hood or bonnet 42 when under impact from a pedestrian thus preventing substantial injury to a head or torso.

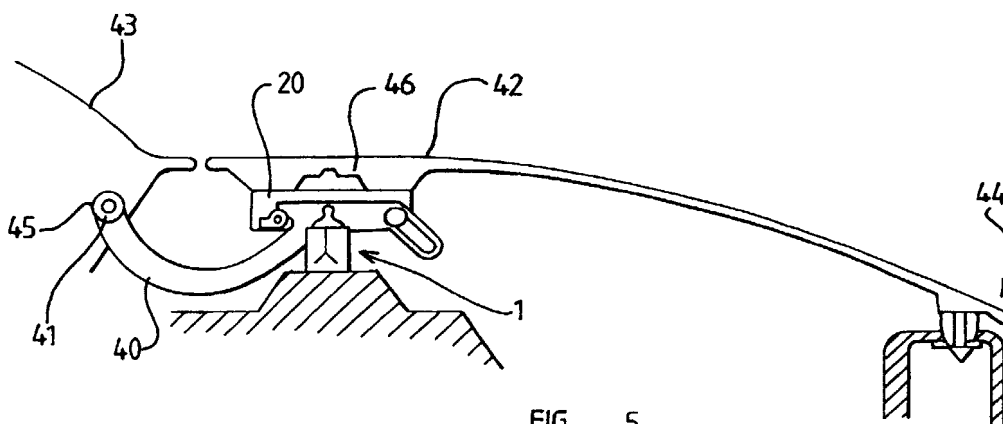


FIG 5

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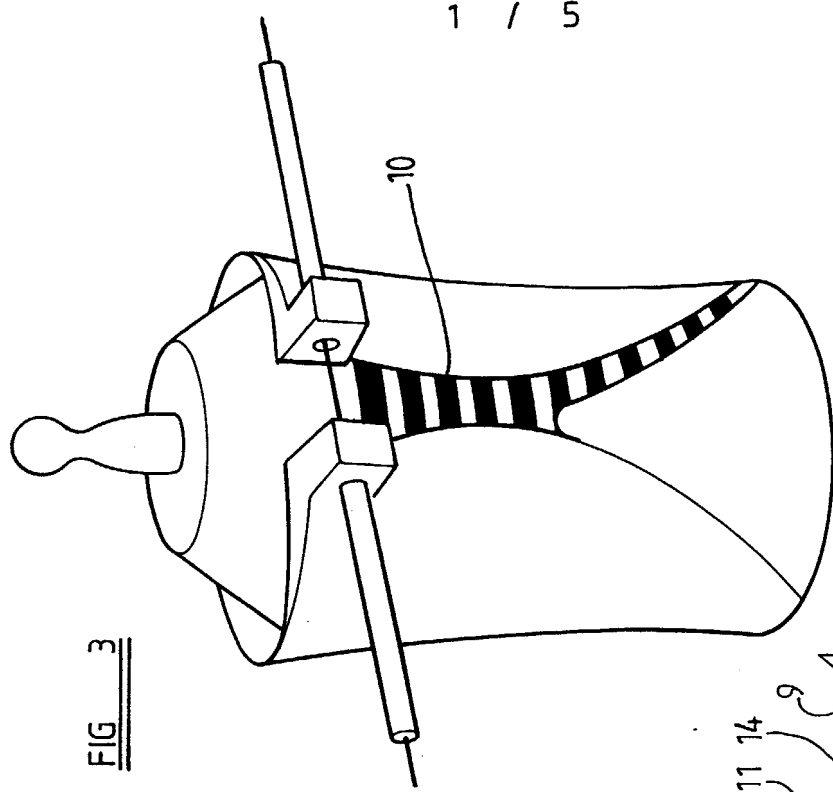


FIG. 1

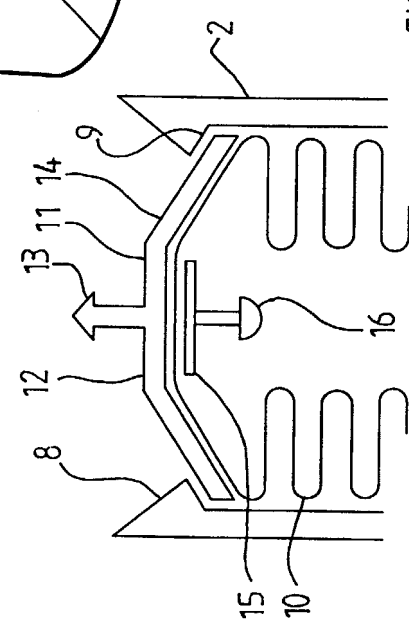


FIG. 2

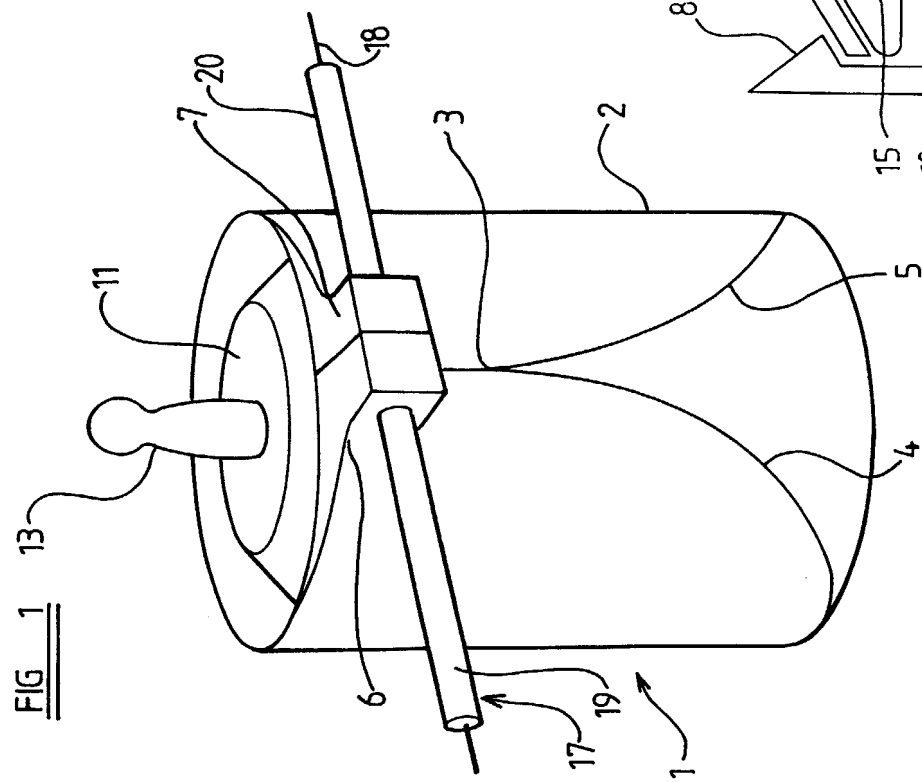
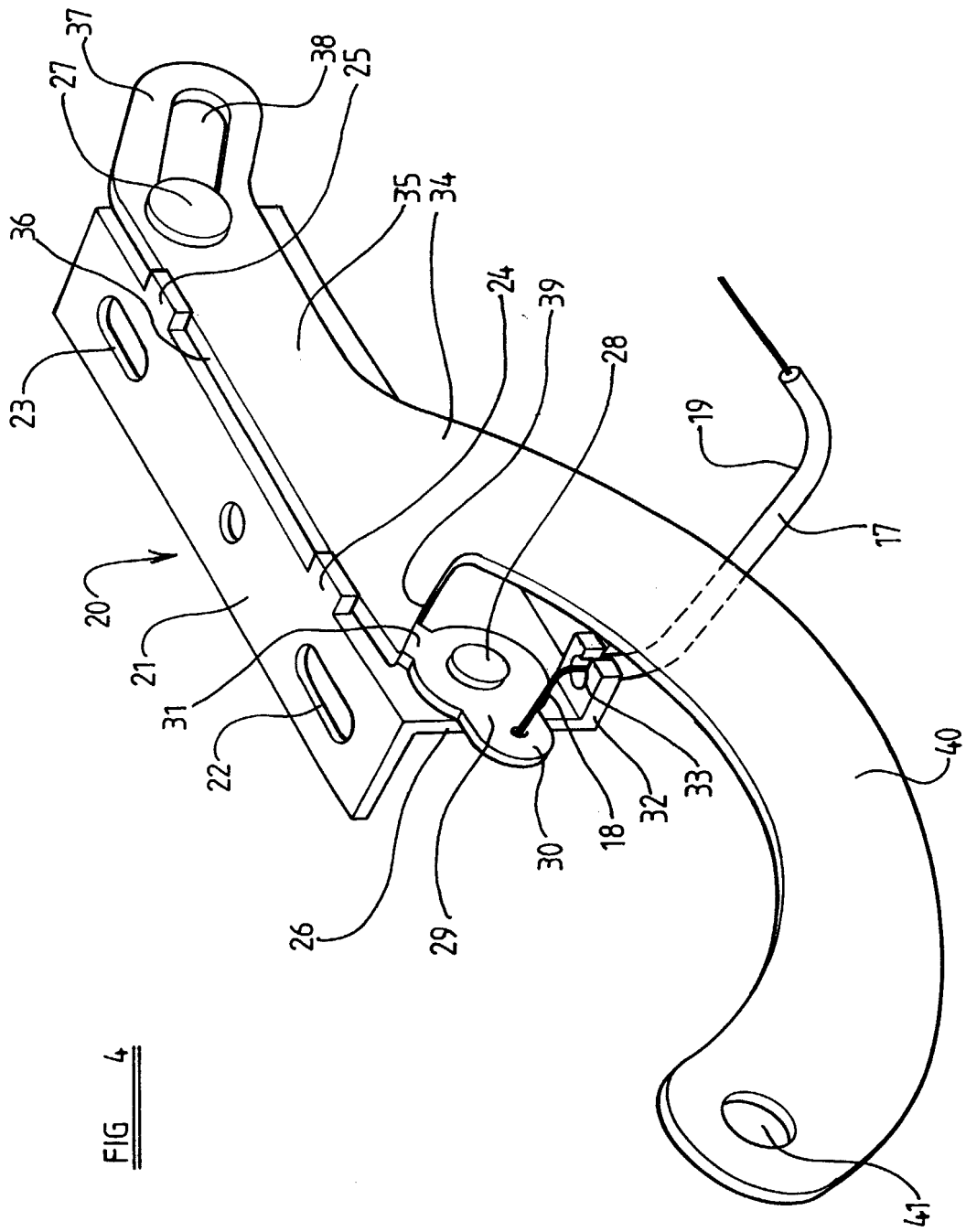
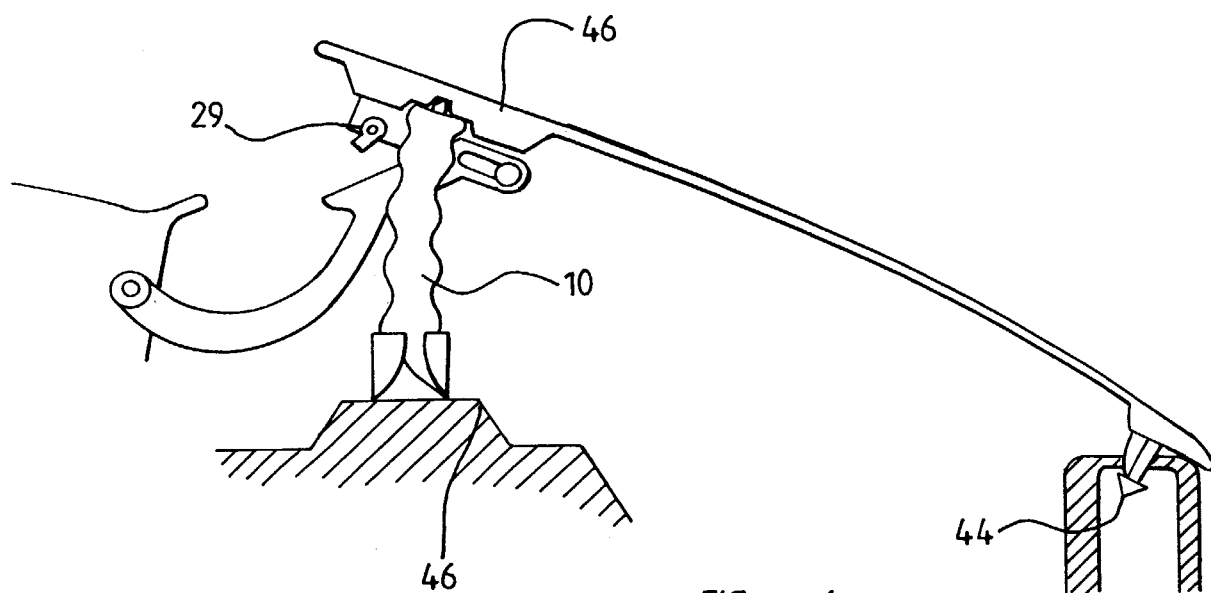
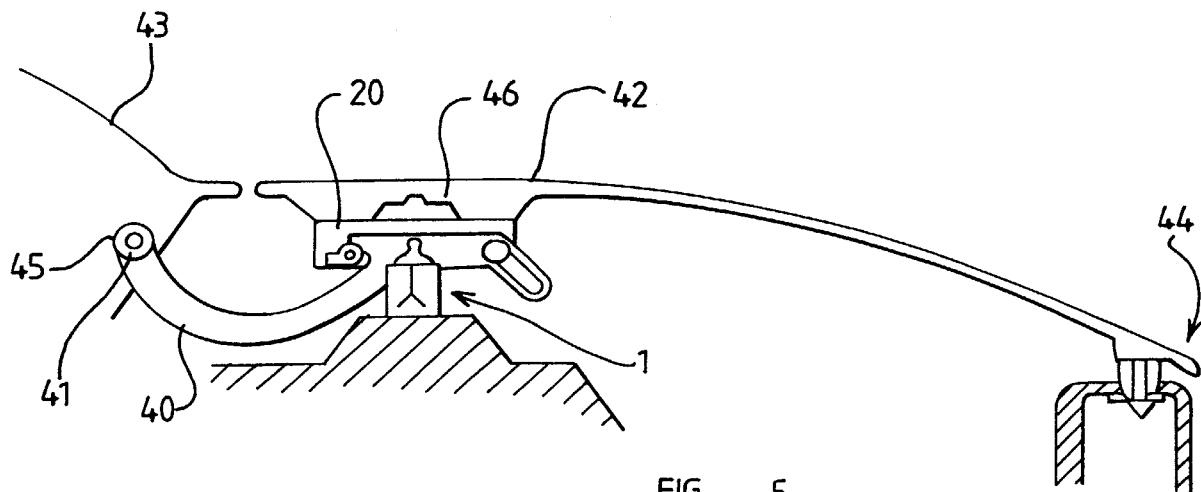
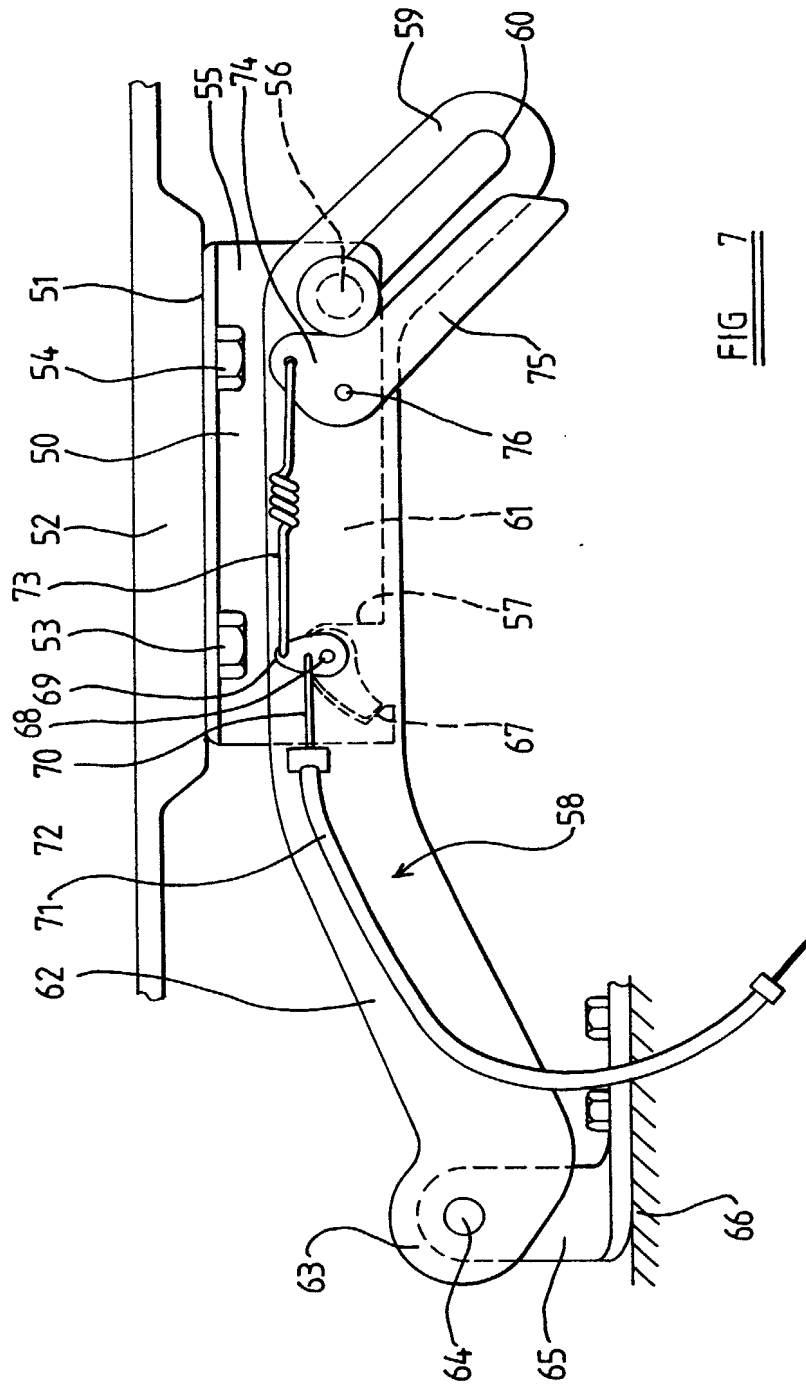
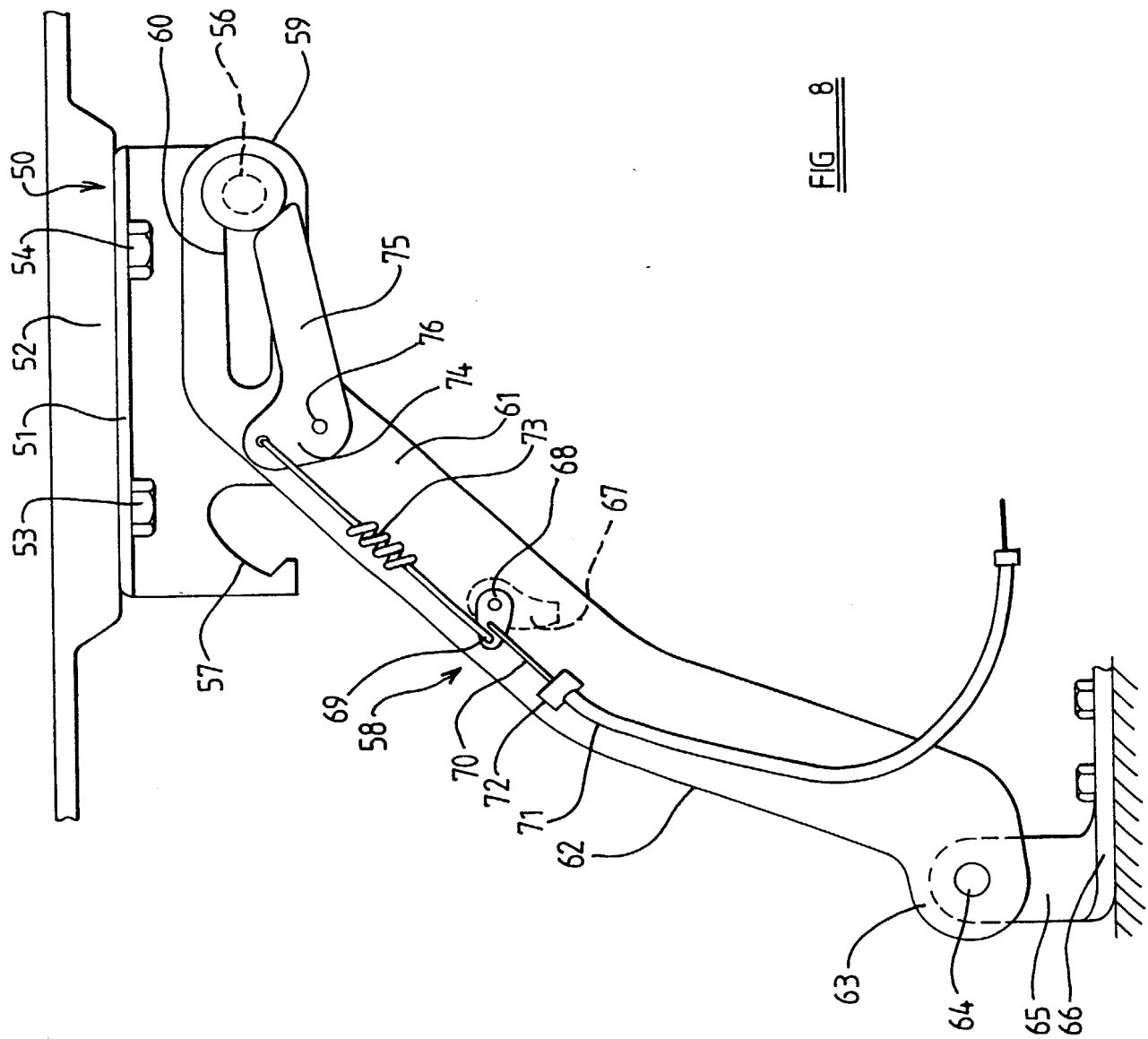


FIG. 3









**DESCRIPTION OF INVENTION****“IMPROVEMENTS IN OR RELATING TO A SAFETY DEVICE”**

**THE PRESENT INVENTION** relates to a safety device, and more particularly relates to a safety device to be mounted on a vehicle to provide protection for a pedestrian struck by the vehicle in an accident situation.

If a pedestrian is struck by a vehicle in an accident situation, the pedestrian may be thrown in such a way that the head or torso of the pedestrian impacts with the hood or bonnet of the motor vehicle. The hood or bonnet of the motor vehicle may deform as a consequence of such impact, but, if the hood or bonnet is closed, the hood or bonnet may only deform by a very short distance before the underside of the hood or bonnet will engage with part of the engine located under the hood or bonnet.

Consequently it has been proposed to provide a mechanism which, in response to the sensing of an impact with a pedestrian, partially raises the hood or bonnet of the vehicle. Thus, when the pedestrian impacts with the hood or bonnet, the hood or bonnet is able to deform over a substantial distance before the underside thereof engages with the engine. During this extensive deformation of the hood or bonnet, the head or torso of the pedestrian may be

decelerated appropriately, relative to the vehicle, without substantial injury arising.

Various arrangements have been proposed to raise the rear part of the bonnet or hood in response to an accident situation involving an impact with a pedestrian. Typically, however, a bonnet or hood is raised for servicing purposes about hinges provided at the rear part of the bonnet. Consequently it has been necessary to devise special hinge arrangements which firstly enable the bonnet to be lifted in the normal way, about a pivot axis defined at the rear of the bonnet or hood by the hinges, and which secondly permit the rear part of the bonnet to be raised in an accident situation.

EP-A-096728 discloses an arrangement of this type. In the embodiments described in this Specification, the rear part of the bonnet or hood is mounted on pivot pins which constitute hinge pins at the rear edge of the hood or bonnet. The pivot pins are received within a vertical channel having an enlarged lower part, one side-wall of the channel being defined by a member which is pivotally connected to the member defining the other side-wall of the channel, the pivotally mounted member being spring-biased so that the channel has a minimum width. The minimum width of the channel is less than the diameter of the pin, apart from in the lower part of the channel. Thus, the pin is retained within the lower part of the channel, but can be released from the channel when subjected to a substantial upward force, the pivotally mounted member defining said one side-wall, the channel then moving slightly against the spring-bias. An arrangement of this type may become disconnected if the rear of the hood or bonnet is subjected to a sudden upward force, for example when travelling along a very uneven road.



DE-A-19957872 discloses another arrangement in which the pivot point about which the hood or bonnet is hinged to the main part of a vehicle is itself provided at the free end of a pivotally mounted arm. In an initial position of the pivotally mounted arm, the hood or bonnet may be opened or closed in a conventional manner. However, in response to an accident situation, an actuator may move the pivotally mounted arm, thus raising the pivot point about which the rear part of the hood or bonnet is connected to the main part of the vehicle. As a consequence, the rear part of the hood or bonnet itself is lifted up. Such an arrangement is relatively complicated.

GB-A-2,354,797 discloses a further hinge arrangement in which the pivot point about which the bonnet usually pivots is connected to the main part of the car by means of a pivotally mounted arm. The pivotally mounted arm is held in a normal position by a catch member, but can pivot to a position in which the rear part of the hood or bonnet is raised, upon release of the catch member. The catch member is adapted to release itself whenever the rear part of the hood or bonnet is subjected to a substantial upward force. Again, an arrangement of this type may malfunction in that the rear part of the bonnet may rise if, for example, the vehicle is travelling along a very uneven road.

A further problem that may be encountered with the arrangements described in DE-A-19957872 and GB-A-2,354,797, is that the rear portion of the bonnet may be constrained to move substantially vertically upwardly. If the bonnet has a latch at the front which normally retains the bonnet in a closed position, that front latch may not permit such vertical movement of the rear part of the bonnet, unless a specially designed latch is provided which is permitted to move appropriately. If such a latch is provided, the consequent movement of the hood or bonnet may reveal hard parts of the underlying chassis in the region

where the pedestrian may strike the car. Alternatively, of course, the latch may break if subjected to an over-large force.

The present invention relates to a safety device of the type intended to lift a hood or bonnet in response to an accident situation involving an impact with a pedestrian.

According to this invention there is provided a safety device to lift the rear part of the hood or bonnet of a motor vehicle, the rear part of the hood or bonnet being connected to the main part of the vehicle by a hinge to permit the front part of the hood or bonnet to be opened, the safety device including the lifting element located beneath the rear part of the hood or bonnet and actuable to lift the rear part of the hood or bonnet, the hinge comprising a hinge arm having one end thereof pivotally connected to the main part of the vehicle, and having part thereof releasably connected to the hood or bonnet, there being a release mechanism to release the said connection in response to actuation of the lifting element.

Preferably the part that is releasably connected to the hood or bonnet by means of a co-operating stud and slot.

Preferably the said other end of the hinge arm defines said slot, the slot being an elongate slot, the elongate slot receiving the stem of the stud.

Conveniently the elongate slot is inclined relative to a linear portion which extends from one end of the slot to the said intermediate part, which is releasably connected to the hood or bonnet.

Advantageously the releasable connection is constituted by a catch being associated with a mechanism to release the catch in response to actuation of the lifting element.

Preferably the catch is associated with a Bowden cable adapted to release the catch.

Advantageously the Bowden cable has the core thereof extending through two lugs provided on the exterior of a canister that forms part of the lifting element, the lugs being adapted to become separated in response to actuation of the lifting element.

In a preferred embodiment the lifting element comprises a canister containing an inflatable sleeve, the side-wall of the canister defining at least one side of weakness passing between said two lugs, the arrangement being such that in response to inflation of the sleeve, the canister ruptures and the lugs move apart.

In one embodiment the catch is mounted on a bracket connected to the bonnet or hood, and engages an inclined end face of a linear part of the hinge arm, retaining the hinge arm in a predetermined position relative to the bracket or hood.

In an alternative embodiment the catch is mounted on the hinge arm, and engages a formation on a mounting bracket connected to the bonnet or hood to retain the hinge arm in a predetermined position relative to the bracket.

Preferably a resiliently biased locking arm is provided, the locking arm being movable from an initial position to a locking position when the stud is

moved to one end of the slot, the arm, in the locking position, serving to retain the stud at that one end of the slot.

Conveniently the locking arm is spring biased by a tension spring, part of the tension being connected to the catch such that tension is applied to the spring when the catch is moved to the release position.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a perspective view of a canister containing an inflatable sleeve to form part of a safety device in a motor vehicle,

FIGURE 2 is a sectional view through the upper part of the canister of Figure 1,

FIGURE 3 is a view of the canister of Figure 1 illustrating the canister when the safety device is being deployed,

FIGURE 4 is a perspective view of a hinge structure,

FIGURE 5 is a diagrammatic side view of part of a motor vehicle incorporating a safety device which includes the canister of Figure 1 and the hinge structure of Figure 4 in an ordinary condition,

FIGURE 6 is a view corresponding to Figure 5 illustrating the safety device in the deployed condition,

FIGURE 7 is a side view of an alternative hinge structure and

FIGURE 8 is a view corresponding to Figure 7 showing the hinge structure in the deployed position.

Referring initially to Figures 1 to 3, a canister 1 form as lifting element which can be actuated to lift the rear part of a bonnet or head of a motor vehicle. The canister 1 comprises a generally cylindrical housing 2 formed, for example, of a plastics material. The cylindrical housing 2 has at least one line of mechanical weakness 3 formed in the side wall thereof, the preferred arrangement of lines of mechanical weakness comprising three lines of mechanical weakness 3, 4, 5, which have a generally inverted "Y"-shaped configuration, with the line of weakness 3 extending vertically towards the very top of the side-wall of the housing. At the top of the side-wall of the canister, on opposed sides of the line of weakness 3, are radially outwardly protruding apertured lugs 6, 7.

At the upper part of the side-wall of the housing 2, as shown in Figure 2, there is provided an inner rim 8, the inner rim 8 having an inwardly inclined under-surface 9.

Contained within the canister is a fabric sleeve 10. The sleeve 10 is, in the described embodiment, initially folded in a "concertina" manner.

The upper-most part of the sleeve 10, contained within the canister 1, is provided with an upper cap 11. The upper cap 11 has a central planar region 12 which carries an upwardly extending barbed prong 13. Surrounding the planar region 12 is a downwardly inclined peripheral annular region 14, the outer-most

peripheral part of which firmly abuts and engages the inclined under-surface 9 of the rim 8 provided on the side-wall of the housing 2. The cap 11 may be secured to the upper part of the fabric sleeve 10 by means of a mounting plate 15 provided within the terminal part of the sleeve 10 which is secured to the cap 11 by means of a screw 16.

A pyrotechnic charge is provided within the canister adapted to inflate the sleeve 10. The lower part of the canister may be provided with a bayonet mounting which can be used to mount the canister in position (as will be described hereinafter) and also to provide electrical contacts to an ignition squib provided within the pyrotechnic charge which is to inflate the sleeve 10.

As shown in Figure 1, a Bowden cable 17 may be associated with the canister. The inner core 18 of the cable will pass through the co-aligned apertures formed in the radially outwardly directed lugs 6 and 7. The sleeve parts 19, 20 of the cable will abut against the exterior parts of the lugs 6 and 7.

It is to be understood that, upon deployment of the safety device, the pyrotechnic charge associated with the sleeve 10 will be ignited, and gas will be injected into the sleeve 10. The sleeve 10 will thus begin to expand. The expansion of the sleeve 10 will cause the housing 2 of the canister 1 to rupture along the lines of mechanical weakness. This rupturing may be assisted by a generally upward force applied to the cap 11 which will cause the inclined peripheral portion 14 of the cap 11 to exert a force on the under-surface 9 of the rim 8 tending to cause the side-walls of the cylindrical housing 2 to distend outwardly, thus splitting the side-wall of the housing 2 along the line of mechanical weakness.

As can be seen in Figure 3, as the fabric sleeve 10 inflates and the cap 11 moves upwardly, so the two radially outwardly directed protrusions 6 and 7 on either side of the split-line 3 move apart which will effectively apply tension to the inner core 18 of the Bowden cable 17.

Turning now to Figure 4, a hinge assembly is illustrated, and it is to be understood that two hinge assemblies of this type will be used to mount the hood or bonnet of a motor vehicle in position, and each will be associated with a canister 1 as described above.

The hinge assembly comprises a mounting bracket 20 which incorporates a rectangular planar plate 21 provided with two spaced-apart mounting apertures 22, 23. The planar plate is adapted to be mounted to the under-side of a hood or bonnet by screws or the like passing through the two mounting apertures 22, 23. At one of the long side edges of the planar plate 21, there are two outwardly extending lugs 24, 25. The lugs 24, 25 extend above and protrude beyond a depending wall 26 which depends from the said long side edge. A "T"-headed stud 27 extends perpendicularly from the depending wall 26 adjacent one end thereof, and a pivot 28 extends perpendicularly from the wall 26 adjacent the other end thereof. The pivot 28 pivotally supports a rotatable catch element 29 which forms part of a release mechanism. The catch element 29 has a first radially extending arm 30 and a second radially extending retainer arm 31. The first arm 30 is connected to the core 18 of the Bowden cable 17. The retainer arm 31 serves to retain part of hinge assembly in position, as will be described below.

Beneath the catch 30 is a horizontally protruding lug 32 which extends horizontally from the lower edge of the depending wall 26. The lug 32 is provided with a recess 33 in one side edge thereof. The recess 33 is

dimensioned so that the core 18 of the Bowden cable may pass through the recess, whilst the sleeve 19 of the Bowden cable engages the lug adjacent the recess. Tension applied to the core 18 of the Bowden cable will cause the catch 29 to rotate.

A hinge arm 34 is provided, the hinge arm having a first linear portion 35 which lies adjacent the depending plate 21. A substantially linear or straight upper edge 36 of the linear portion 35 engages the under-surface of each of the lugs 24, 25. At one end of the linear part 35 there is an inclined extension 37 of the hinge arm, the extension 37 having an oval slot 38 therein. The slot 38 is inclined relative to the edge 36. The "T"-headed stud 27 passes through the slot 38. The stem of the stud is dimensioned to slide along the slot.

At the other end of the linear part 35 of the hinge arm 34, there is an inclined end surface 39 which is engaged by the retaining arm on the catch element 29. The end surface 39 is thus releasably connected to the bracket 20 which, in turn, is connected to the hood or bonnet. The inclined end surface 39 is located intermediate the two ends of the hinge arm. The arrangement is such that, with the catch element 29 in a latching position, as shown in Figure 4, the end face of the retaining arm 31 engages the inclined end face 39 of the linear portion 35 of the hinge arm 34, and consequently the hinge arm 34 is retained fast with the mounting bracket 20. However, if the catch element 29 is rotated in an anti-clockwise manner by tension applied to the core 18 of the Bowden cable 17, then the hinge arm 34 is released and may move relative to the bracket 20 whilst being restrained by the engagement between the "T"-headed stud 27 and the slot 38.



The linear portion 35 of the hinge arm 34 is connected to an elongate arcuate portion 40 of the hinge arm which terminates with a mounting aperture 41.

Referring now to Figure 5, part of a motor vehicle is illustrated. Figure 5 shows the hood or bonnet 42 of the motor vehicle, which is mounted in position in front of the windscreen or windshield 43. The forward-most end of the hood or bonnet is provided with a releasable catch 44, of conventional design, to release the hood or bonnet to provide access to the engine space beneath the hood or bonnet. Towards the rear of the hood or bonnet, the mounting plate 20 of a hinge assembly, as shown in Figure 4 is mounted to the under-side of the hood or bonnet, and the arcuate portion 40 of the hinge arm 34 is connected, by means of the aperture 41, to a pivotal mounting point 45 located on the main part of the motor vehicle adjacent the base of the windscreen 43. Two hinge assemblies will be provided, one on each side of the vehicle. A recess or 'socket' 46 is provided on the underside of the head or bonnet above the canister 1 to receive the barbed prong 13 when the safety device is deployed.

The free end of the Bowden cable 17 may be connected to an actuating lever provided on the interior of the motor vehicle or, alternatively, may be mounted to a fixed point.

A canister 1, as described above, is mounted in position beneath part of the head or bonnet adjacent the horizontal plate 21 of each bracket 20, being mounted in position appropriately, for example, by the described bayonet connection, on a firm or immovable part 46 of the motor vehicle. Thus there is a respective canister 1 on each side of the vehicle. The barbed prong 13 is located beneath the recess or socket 46. The hood or bonnet may be opened in

the normal way by releasing a conventional catch 44 provided at the front of the hood or bonnet 42, and then lifting the forward-most edge of the hood or bonnet. The hood or bonnet will pivot about the pivotal mounting 45. The linear portion 35 of the hinge arm 34 will remain fast with the bracket 20, because it will be retained in this condition by a combination of the "T"-headed stud 27 at one end of the elongate slot 38, and the retaining arm 31 of the catch 29.

In the event that an accident should occur involving an impact with a pedestrian, the safety device will be deployed. As described above, each housing 2 will rupture, permitting the sleeve 10 to expand. The cap 11 will move upwardly and the barbed prong 13 present on the cap 11 move upwardly to engage with the recess or socket 46, and the action of the barbed prong will prevent the end cap 11 from subsequently becoming disengaged from the recess or socket 46. As the housing 2 ruptures, so tension will be applied to the Bowden cable which will serve to rotate the catch 29 to a position in which the radial arm 31 no longer has the end face thereof engaging the end wall 39 of the linear portion 35 of the hinge arm 34, thus effectively releasing the linear part 35 of the hinge arm, permitting the hinge arm to rotate, relative to the bracket 20, about the axis defined by the "T"-headed stud 27.

As the sleeves 10 continues to inflate, the sleeves 10 will extend upwardly, thus forcing the rearward part of the hood or bonnet upwardly. The hood or bonnet will then pivot about the conventional catch 44 provided at the front of the hood or bonnet. As the rear part of the hood or bonnet moves upwardly, so the hinge arm 34 of each hinge will pivot about the pivot axis 45, and the "T"-headed bush 27 will slide along the elongate slot 38. When the "T"-headed bush 27 reaches the other end of the elongate slot 38, further upward movement of the hood or bonnet will be prevented.

It is to be appreciated that as the rear part of the hood or bonnet rises, the rear part is not constrained to rise vertically. Because the "T"-headed bush can slide along the elongate slot 38, the hood or bonnet can actually effect a pivoting movement which is about an axis substantially coincident with the conventional catch 44 provided at the front of the hood or bonnet. A typical conventional catch can tolerate movement of this type without breaking, and the movement is such that no hard part of the underlying chassis of the vehicle is revealed during the movement.

Referring now to Figures 7 and 8, an alternative hinge structure is illustrated.

The basic design of the hinge structure is extremely similar to that of the hinge of Figures 4 to 6.

Referring initially to Figure 7, a hinge assembly is illustrated in side view. Again, two hinge assemblies of this type will be utilised to secure a bonnet or hood of a motor vehicle to the main part of the vehicle.

The hinge assembly comprises a mounting bracket 50, of "L" section. The bracket 50 thus comprises a horizontal upper plate 51 which is secured to the bonnet 52 of the vehicle by means of two bolts 53, 54. The bracket incorporates a depending plate 55 which depends from one edge of the plate 51, the depending plate having, at one end thereof, a horizontally extending pin or "T" headed stud 56. At the other end of the plate a recess 57 is defined which will, as will be described below, co-operate with a catch. The recess has an opening in the lower edge of the depending plate 55.

A hinge arm 58 is provided, the hinge arm being of elongate form. The hinge arm has a first terminal region 59 provided with an elongate slot 60 therein, the axis of the slot being co-aligned with the axis of the terminal region 59.

The terminal region 59 is provided adjacent one end of a linear region 61 which is connected by a curved region 62 of the hinge arm to a second terminal region 63. The second terminal region 63 is provided with an aperture therein which receives a pin 64. The pin 64 provides a pivotal support for the hinge arm 58. The pin 64 is received in a bracket 65 which is mounted on the main part 66 of the vehicle.

The hinge arm 58 carries a catch member 67 which is pivotally connected, by means of a pivot pin 68 to the linear portion 61 of the hinge arm 58. The catch member 67 is provided with a radially extending actuating arm 69. Connected to the actuating arm 69 is the core 70 of a Bowden cable 71, the sleeve of the Bowden cable 71 being retained by an apertured lug 72 which is mounted on the hinge arm 58. Tension applied to the Bowden cable 71 will tend to rotate the catch member 67.

Also connected to the radially extending arm 69 is one end of a tension spring 73 the other end of which is connected to an actuating lug 74 provided at one end of a locking arm 75. The locking arm 75 is of elongate form, and is pivotally mounted, by pivot 76, to the linear part 61 of the hinge arm 58. The pivot 76 is at the end of the arm 75 that has the activating lug 74. The configuration of the actuating lug 74 and the locking arm 75 is such that tension applied to the lug by the spring 73 will tend to cause the locking arm to rotate

about the pivot 76. The locking arm 75 is located in position such that the locking arm may be in engagement with the head of the "T" headed stud 56.

When the hinge is in its normal or undeployed condition the catch member 67 carried by the hinge arm 58 is received within the recess 57 defined in the depending plate 55. The configuration of the recess 57 is such that when the catch member is in position, that part of the hinge arm adjacent the catch member cannot move upwardly, because engagement of part of the catch member with the corresponding part of the recess and also cannot move downwardly, again because of engagement between part of the catch member and the corresponding part of the recess. Thus the hinge arm is held fast with the depending plate 55 enabling the hood or bonnet 52 to be opened in a conventional manner about a pivot axis defined by the pivot pin 64.

Again, when the hinge assembly is in its initial condition the "T" headed stud 56 is at the end of the oval slot 60 which lies adjacent to the linear portion 61 of the hinge arm 58. The "T" headed stud 56 engages the locking arm 65 in the region where the locking arm and the actuating lug 75 merge. The locking arm 75 extends substantially parallel with the oval slot 60.

When tension is applied to the core of the Bowden cable, for example as a consequence of actuation of a canister as shown in Figures 1 to 3 which is connected to the Bowden cable, the catch member 67 will pivot about the pivot access 68, thus releasing the catch member from the recess 57 enabling the catch member to move downwardly out of the recess from the position illustrated in Figure 7, thus enabling the hinge assembly to move towards the condition illustrated in Figure 8. Simultaneously tension is applied to the spring 73, since the actuating arm 69 will have pivoted in such a sense as to apply tension to the spring 73. Consequently, a spring force is applied to the

locking arm 75 thus urging the arm 75 firmly into engagement with the "T" headed stud 56.

As the rear part of the hood or bonnet 52 which is connected to the hinge assembly moves upwardly, again in consequence of the deployment of a canister such as that shown in Figures 1 to 3, the hinge arm 58 will pivot about the axis defined by the pivot pin 64, and, as in the previously described embodiment, the "T" headed stud 56 will tend to slide along the elongate slot 60 towards the end thereof adjacent the termination of the terminal region 59 of the hinge arm 58.

When the "T" headed stud 56 does reach the terminal end of the slot 60, the locking arm 75 may rotate slightly so that the very end of the locking arm engages the "T" headed stud 56 thus preventing the "T" headed stud 74 from sliding back along the slot. Thus the locking arm serves to lock the rear part of the hood or bonnet in the fully elevated condition.

Following deployment of the canister as shown in Figures 1 to 3, when the inflatable sleeve 10 deflates, which will occur after a predetermined period of time, the lugs 6 and 7 resiliently return to their initial relative position, and tension will no longer be applied to the core 70 of the Bowden cable 71. Thus the tension applied to the spring 73 will be reduced. The weight of the bonnet acting downwardly will then be sufficient to enable the force applied by the "T" headed stud 74 to the end of the locking arm 75 to return the locking arm towards its initial position in which the locking arm extends generally parallel with the elongate slot 60, thus enabling the "T" headed stud 74 to slide along the slot back to the initial position. The hood or bonnet will thus, under the influence of gravity, return to the initial lowered position.

Consequently, should the safety device be triggered inappropriately, or should the vehicle continue along the road after the safety device has been actuated, the hood or bonnet will not remain elevated for a protracted period of time, but instead the hood or bonnet will automatically return to the lowered position. Thus, the view of the diver will only be obscured while the bonnet is in the elevated position.

In the present Specification "comprises" means "includes or consists of" and "comprising" means "including or consisting of".

The features disclosed in the foregoing description, or the following Claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

## CLAIMS:

1. A safety device to lift the rear part of the hood or bonnet of a motor vehicle, the rear part of the hood or bonnet being connected to the main part of the vehicle by a hinge to permit the front part of the hood or bonnet to be opened, the safety device including the lifting element located beneath the rear part of the hood or bonnet and actuable to lift the rear part of the hood or bonnet, the hinge comprising a hinge arm having one end thereof pivotally connected to the main part of the vehicle, and having part thereof releasably connected to the hood or bonnet, there being a release mechanism to release the said connection in response to actuation of the lifting element.
2. A safety device according to Claim 1 wherein the part that is releasably connected to the hood or bonnet is intermediate the two ends of the hinge arm.
3. A device according to Claim 2 wherein the other end of the hinge arm is connected to the hood or bonnet by means of a co-operating stud and slot.
4. A device according to Claim 3 wherein the said other end of the hinge arm defines said slot, the slot being an elongate slot, the elongate slot receiving the stem of the stud.
5. A device according to Claim 4 wherein the elongate slot is inclined relative to a linear portion which extends from one end of the slot to the said intermediate part, which is releasably connected to the hood or bonnet.



6. A device according to any one of the preceding Claims wherein the releasable connection is constituted by a catch, the catch being associated with a mechanism to move the catch to a release position in response to actuation of the lifting element.

7. A device according to Claim 6 wherein the catch is associated with a Bowden cable adapted to release the catch.

8. A device according to Claim 7 wherein the Bowden cable has the core thereof extending through two lugs provided on the exterior of a canister that forms part of the lifting element, the lugs being adapted to become separated in response to actuation of the lifting element.

9. A device according to Claim 8 wherein the lifting element comprises a canister containing an inflatable sleeve, the side-wall of the canister defining at least one side of weakness passing between said two lugs, the arrangement being such that in response to inflation of the sleeve, the canister ruptures and the lugs move apart.

10. A device according to any one of claims 6 to 9 wherein the catch is mounted on a bracket connected to the bonnet or hood and engages an inclined end face of a linear part of the hinge arm, retaining the hinge arm in a predetermined position relative to the bracket.

11. A device according to any one of claims 6 to 9 wherein the catch is mounted on the hinge arm, and engages a formation on a mounting bracket connected to the bonnet or hood to retain the hinge arm in a predetermined position relative to the bracket.

12. A device according to claim 2 or any claim dependent thereon wherein a resiliently biased locking arm is provided, the locking arm being movable from an initial position to a locking position when the stud is moved to one end of the slot, the arm, in the locking position, serving to retain the stud at that one end of the slot.
13. A device according to claim 12 as dependent on claim 11 wherein the locking arm is spring biased by a tension spring, part of the tension spring being connected to the catch such that tension is applied to the spring when the catch is moved to the release position.
14. A safety device substantially as herein described with reference to and as shown in the accompanying drawings.
15. Any novel feature or combination of features disclosed herein.

Amendments to the claims have been filed as follows

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CLAIMS:

1. A safety device to lift the rear part of the hood or bonnet of a motor vehicle, the rear part of the hood or bonnet being connected to the main part of the vehicle by a hinge to permit the front part of the hood or bonnet to be opened, the safety device including a lifting element located beneath the rear part of the hood or bonnet and actuable to lift the rear part of the hood or bonnet, the hinge comprising a hinge arm having one end thereof pivotally connected to the main part of the vehicle, and having part thereof releasably connected to the hood or bonnet by means of a catch, the catch being associated with a mechanism operable to move the catch to a release position to permit the rear part of the hood or bonnet to be lifted upon actuation of the lifting element.
2. A safety device according to Claim 1 wherein the part that is releasably connected to the hood or bonnet is intermediate the two ends of the hinge arm.
3. A device according to Claim 2 wherein the other end of the hinge arm is connected to the hood or bonnet by means of a co-operating stud and slot.
4. A device according to Claim 3 wherein the said other end of the hinge arm defines said slot, the slot being an elongate slot, the elongate slot receiving the stem of the stud.
5. A device according to Claim 4 wherein the elongate slot is inclined relative to a linear portion which extends from one end of the slot to the said intermediate part, which is releasably connected to the hood or bonnet.
6. A device according to any preceding claim wherein the catch is associated with a Bowden cable adapted to release the catch.

7. A device according to Claim 6 wherein the Bowden cable has the core thereof extending through two lugs provided on the exterior of a canister that forms part of the lifting element, the lugs being adapted to become separated in response to actuation of the lifting element.

8. A device according to Claim 7 wherein the lifting element comprises a canister containing an inflatable sleeve, the side-wall of the canister defining at least one side of weakness passing between said two lugs, the arrangement being such that in response to inflation of the sleeve, the canister ruptures and the lugs move apart.

9. A device according to any preceding claim wherein the catch is mounted on a bracket connected to the bonnet or hood and engages an inclined end face of a linear part of the hinge arm, retaining the hinge arm in a predetermined position relative to the bracket.

10. A device according to any preceding claim wherein the catch is mounted on the hinge arm, and engages a formation on a mounting bracket connected to the bonnet or hood to retain the hinge arm in a predetermined position relative to the bracket.

11. A device according to Claim 2 or any claim dependent thereon wherein a resiliently biased locking arm is provided, the locking arm being movable from an initial position to a locking position when the stud is moved to one end of the slot, the arm, in the locking position, serving to retain the stud at that one end of the slot.

12. A device according to Claim 11 as dependent on Claim 10 wherein the locking arm is spring biased by a tension spring, part of the tension spring

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being connected to the catch such that tension is applied to the spring when the catch is moved to the release position.

13. A safety device substantially as herein described with reference to and as shown in the accompanying drawings.

14. Any novel feature or combination of features disclosed herein.



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**Application No:** GB 0208798.9  
**Claims searched:** 1 - 14

**Examiner:** Beverley Lloyd  
**Date of search:** 12 August 2002

## Patents Act 1977 Search Report under Section 17

### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): B7B (BSBNC, BAM)

Int Cl (Ed.7): B60R 21/34; B62D 25/10, /12

Other: Online: WPI, EPODOC, JAPIO

### Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	EP 0967128 A2 (NISSAN) See Figs 5 & 6,	1 - 3
X	WO 01/23226 A1 (FORD) See Figs; line 20, page 9 - line	1 - 3, 6, 10 & 11
X	DE 19957872 A1 (VOLKSWAGEN) See Figs & Abstract	1 - 3

X Document indicating lack of novelty or inventive step  
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A Document indicating technological background and/or state of the art.  
P Document published on or after the declared priority date but before the filing date of this invention.  
E Patent document published on or after, but with priority date earlier than, the filing date of this application.